

Lists of Larval Worms from Marine Invertebrates of the Pacific Coast of North America

HILDA LEI CHING

Hydra Enterprises Ltd., P.O. Box 2184, Vancouver, British Columbia, Canada V6B 3V7

ABSTRACT: Immature stages of 73 digenetic trematodes are listed by their families, marine invertebrate hosts, and localities and then cross listed according to their molluscan hosts. The list contains many new host records, and larval stages of 15 digenetic trematodes were newly recorded from gastropods from British Columbia and California. A list of immature stages of 14 cestodes, acanthocephalans, and nematodes is also included.

KEY WORDS: Digenea, Cestoda, Acanthocephala, Nematoda, marine mollusks, invertebrate hosts, Pacific coast, North America.

Although immature stages are recognized to be as important as adults in the descriptions of parasites, few studies focus on larval helminths in marine invertebrates. Stunkard (1983) pointed out the difficulties in conducting studies on marine parasites but the necessity to do so should concern all biologists interested in making inventories of parasites and in conserving biodiversity (Pritchard, 1989). The marine ecosystem has become particularly vulnerable to physical changes which in turn can affect both host and parasite populations. My studies of larval digenetic trematodes began in 1957 at Friday Harbor, Washington. Since then, many parasites were found in marine invertebrates from British Columbia to California. Additional sampling was not possible, or when recent collections were attempted, snails and clams were found to be scarce due to oil pollution, or successive changes in the physical environment, or the use of lead-based paints on boats. In this paper I provide lists of larval stages of digenetic trematodes, cestodes, acanthocephalans, and nematodes along with their hosts and localities.

Methods and Materials

Snails, clams, and other invertebrates have been collected by the author at Friday Harbor, Washington (WA), and Vancouver, British Columbia (BC). Eric Cabot collected subtidal snails at Saturnina Island, BC; W. P. Sousa provided infected *Cerithidea* snails from Bolinas Lagoon, California (CA), and G. M. Ruiz gave specimens from clams from Bodega and San Francisco bays, CA. Mollusks were isolated to find free-swimming parasites and then dissected to obtain larval stages. The parasites were studied alive with the use of vital dyes. For permanent preparations, they were usually fixed in hot seawater, transferred to alcohol-formalin-acetic acid and stored in 70% ethanol. They were stained with Semichon's carmine and mounted in permount. Most of the measurements were made on preserved specimens. Measurements are given in micrometers unless otherwise indicated with the mean in parentheses. Drawings were made with the aid of a camera lucida.

Stages that I have reported for the first time are designated with *mihi*. Host and distribution records not previously published are indicated in the list with asterisks. The names of the molluscan hosts and common names when given are cited according to Abbott (1974) and those of other invertebrates are cited according to Austin (1985). Accession numbers are given for specimens in the United States National Museum Helminthological Collections.

List 1. Larval Digeneans from Marine Invertebrates from the North American Pacific Coast

Class TREMATODA

Subclass DIGENEA

Order STRIGEIFORMES

Family CYATHOCOTYLIDAE

1. *Mesostephanus appendiculatus* (Ciurea, 1916) Lutz, 1935

Stage: Furcocercous cercaria

Location: Sporocyst in mantle

Host: *Cerithidea californica* Haldeman, California
Horn Shell

Localities: Upper Newport Bay, Bolinas Lagoon, CA

Records: Martin (1961, 1972), Ching and Sousa, 1986*

USNM Helm. Coll. No. 81066

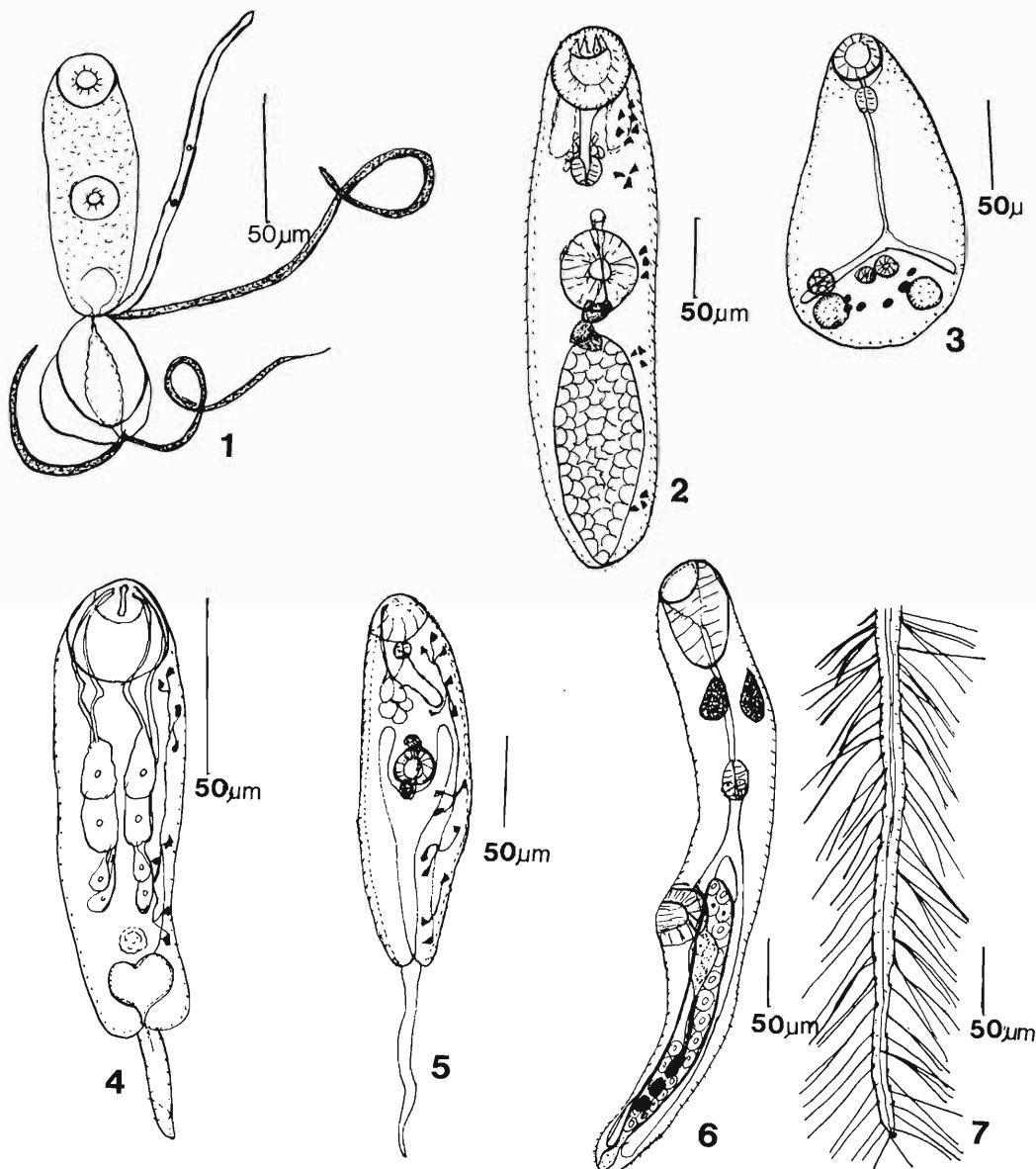
2. Cyathocotylid species

Stage: Furcocercous cercaria

Location: Sporocyst in digestive gland

Host: *Cerithidea californica*

Localities: Upper Newport Bay, Bolinas Lagoon, CA



Figures 1-7. Marine digenleans from gastropod hosts. 1. Hemiuroid cercaria from *Alvania compacta*. 2. Enenterid cercaria from *A. compacta*. 3. Metacercaria of *Microphallus* sp. from *A. compacta*. 4. Microphallid cercaria from *Littorina scutulata*. 5. Renicolid cercaria from *Cerithidea californica*. 6. Body of lepocreadiid cercaria from *Nitidella carinata*. 7. Tail of lepocreadiid cercaria.

Records: Martin (1972), Ching and Sousa, 1986*
USNM Helm. Coll. No. 81067

Family SCHISTOSOMATIDAE

3. *Austrobilharzia variglandis* (Miller and Northup, 1926) Penner, 1953
Stage: Furcocercous cercaria
Location: Sporocyst in gonads
Host: *Ilyanassa obsoleta* (Say), Eastern Mud Nassa

Locality: Vancouver, BC

Record: Ching, 1964*, identification according to Stunkard and Hinchliffe (1952)

4. *Austrobilharzia* sp.

Stage: Furcocercous cercaria
Location: Sporocyst in digestive gland
Host: *Cerithidea californica*
Locality: Upper Newport Bay, CA
Record: Martin (1972)

5. *Cercaria littoralinae* Penner, 1950
 Stage: Furcocercous cercaria
 Location: Not mentioned, sporocyst in digestive gland?
 Host: *Littorina planaxis* Philippi, Eroded Periwinkle
 Locality: Southern California
 Record: Penner (1950)

Order HEMIURIFORMES
 Family HEMIURIDAE

6. *Cercaria B* Miller, 1925
 Stage: Cystophorous cercaria
 Location: Redia in digestive gland
 Host: *Nucella lamellosa* (Gmelin), Frilled Dogwinkle
 Locality: Friday Harbor, WA
 Records: Miller (1925), Ching (1960)

7. *Cercaria C* Ching, 1960
 Stage: Cystophorous cercaria
 Location: Redia in digestive gland
 Host: *Dentalium dalli* Pilsbry and Sharp
 Locality: Friday Harbor, WA
 Record: Ching (1960)

8. Hemiuroid Metacercaria
 Stage: Metacercaria
 Location: Hemocoel
 Host: *Mesamphiascus parvus*
 Locality: Friday Harbor, WA
 Record: Ching (1960). The generic name of the host is not listed by Austin (1985), and the copepod may be *Amphiaccus parvus*.

9. Hemiuroid Metacercaria
 Stage: Metacercaria
 Location: Unknown
 Host: *Bolinopsis microptera*
 Locality: Puget Sound, WA
 Record: Lloyd (1938). *Bolinopsis microptera* is a synonym of the ctenophore, *B. infundibulum* (Muller), according to Austin (1985).

10. Hemiuroid Cercaria *mihi 1* (Fig. 1)
 Stage: Cystophorous cercaria
 Location: Redia in digestive gland
 Host: *Alvania compacta* Carpenter, Compact Alvania
 Locality: Saturnina I., BC
 Record: Ching, 1977*
 USNM Helm. Coll. No. 81068
 Notes: The prevalence was 3 of 487 of the subtidal snails. The rediae are elongate about 1 mm in length. The cercaria has a delivery tube and 3 appendages.

11. *Lecithaster salmonis* Yamaguti, 1934
 Stage: Cystophorous cercaria
 Location: Redia in digestive gland
 Hosts: *Nucella canaliculata* Duclos, Channeled Dogwinkle; *N. emarginata* (Deshayes), Emarginate Dogwinkle
 Localities and records: Friday Harbor, WA, by Miller as *Cercaria A* (1925) and Ching (1960); BC, by Boyce (1966) as *L. gibbosus*.

Family BUCEPHALIDAE

12. *Cercaria noblei* Giles, 1962
 Stage: Furcocercous cercaria

Location: Sporocyst in digestive gland
 Host: *Mytilus californianus* Conrad, Californian Mussel
 Locality: Dillon Beach, CA
 Record: Giles (1962)

13. Bucephalid Cercaria *mihi 2*
 Stage: Furcocercous cercaria
 Location: Sporocyst in digestive gland
 Host: *Lyonsia* sp.
 Locality: Friday Harbor, WA
 Record: Ching, 1958*
 Note: The cercaria and host species are similar to those of *Rhipidocotyle* spp. described by Stunkard (1976).

Family FELLODISTOMIDAE

14. *Pronoprymna petrowi* (Layman, 1930) Bray and Gibson, 1980
 Stage: Trichocercous cercaria
 Location: Sporocyst in digestive gland
 Host: *Macoma inconspicua* (Broderip and Sowerby), Inconspicuous Macoma
 Locality: Vancouver, BC
 Records: Ching, 1963*, 1974*, 1989*
 USNM Helm. Coll. No. 81069
 Notes: The prevalence in 1963 was 2.7% or 27 of 1,138 clams. The cercaria resembled young forms found in smelt hosts in the arrangement and development of the gonads (Margolis and Ching, 1965).

15. Fellodistomid Metacercaria *mihi 3*
 Stage: Metacercaria
 Location: Digestive gland
 Host: *Tapes philippinarum* (Adams and Reeve), Japanese Littleneck
 Locality: Vancouver I., BC
 Record: Ching, 1987*
 Notes: About 150 clams from 15 areas were sampled with 1–2 metacercariae found in 7 of 15 clams in 1 area.

Family GYMNOPHALLIDAE

16. *Cercaria margaritensis* Ching, 1982
 Stage: Furcocercous germinal sac
 Location: Germinal sac in extrapallial cavity
 Hosts: *Margarites costalis* (Gould), Northern Rosy Margarite; *M. helicinus* (Phipps), Helicina Margarite; *M. pupillus* (Gould), Puppet Margarite
 Locality: Saturnina I., BC
 Record: Ching (1982)
 USNM Helm. Coll. No. 81070

17. *Gymnophallus deliciosus* (Olsson, 1893) Odhner, 1900
 Stage: Metacercaria
 Location: Extrapallial cavity
 Host: *Mytilus edulis* L., Blue Mussel
 Locality: Vancouver, BC
 Record: Ching, 1963*, identified from Stunkard and Uzmann (1958)
 USNM Helm. Coll. No. 81071

18. *Gymnophallus somateriae* (Levinson, 1881) Odhner, 1900
 Stage: Furcocercous cercaria
 Location: Sporocyst in digestive gland
 Stage: Metacercaria
 Location: Extrapallial cavity

Host for 2 stages: *Macoma inconspicua*
 Locality: Vancouver, BC
 Records: Ching (1973), 1963*, 1976* for cercaria
 USNM Helm. Coll. Nos. 81072, 81073

19. *Gymnophallus* sp.
 Stage: Metacercaria
 Location: Extrapallial cavity
 Hosts: *Cryptomya californica* (Conrad), California Glass Mya; *Mya arenaria* (L.), Soft-shell Clam
 Record: Ching, 1962*, identified from Stunkard and Uzmann (1958)
 USNM Coll. No. 81074

20. *Lacunovermis conspicuus* Ching, 1965
 Stage: Furcocercous cercaria
 Location: Sporocyst in digestive gland
 Stage: Metacercaria
 Host for 2 stages: *Macoma inconspicua*
 Locality: Vancouver, BC
 Record: Ching (1965a)

21. *Meiogymnophallus multigemmulus* Ching, 1965
 Stage: Metacercaria
 Location: Sporocyst in digestive gland
 Host: *Macoma inconspicua*
 Locality: Vancouver, BC
 Record: Ching (1965a)

22. *Parvatrema borealis* Stunkard and Uzmann, 1958
 Stage: Furcocercous cercaria
 Location: Sporocyst in digestive gland
 Stage: Metacercaria
 Location: Extrapallial cavity
 Hosts for 2 stages: *Nuticola tantilla* (Gould), *Tantilla Transennella*; *Gemma gemma* (Totten), Amethyst Gem Clam
 Localities and records: Friday Harbor, WA, by Ching, 1959*; San Francisco Bay, CA, by Oglesby (1965); Bodega Bay, CA, by Ching and Ruiz, 1986*
 USNM Helm. Coll. No. 81075

23. *Parvatrema obscurus* (Ching, 1960) James, 1964
 Stage: Metacercaria
 Location: Digestive gland
 Hosts: "Collisella" scabra (Gould), Rough Limpet; *Lottia digitalis* (Rathke), Fingered Limpet
 Localities: Bodega Bay to San Nicholas I., CA
 Record: Ching and Grosholz (1988)
 USNM Helm. Coll. No. 79923

24. Gymnophallid Metacercaria
 Stage: Metacercaria
 Location: Gills, mantle
 Host: *Crassostrea gigas* (Thunberg), Giant Pacific Oyster
 Localities: Broughton I., Fanny Bay, Vancouver I., BC
 Record: Bower, 1987, pers. comm., Pacific Biological Station, Nanaimo, BC

Order PLAGIORCHIFORMES
 Family ACANTHOCOLPIDAE

25. *Cercaria foliatae* Miller, 1925
 Stage: Ocular cercaria
 Location: Sporocyst in digestive gland
 Host: *Ceratostoma foliatum* (Gmelin), Foliated Thorn Purpura
 Locality: Friday Harbor, WA
 Record: Miller (1925). This cercaria is placed in this family because of its resemblance to the cercaria of *Stephanostomum baccatum* described by Wolfgang (1955) and the close relationship of the hosts.

Family ENENTERIDAE

26. Enenterid Cercaria *mihi* 4 (Fig. 2)
 Stage: Tail-less cercaria
 Location: Redia in digestive gland
 Host: *Alvania compacta*
 Locality: Saturnina I., BC
 Record: Ching, 1978*
 USNM Helm. Coll. No. 81076
 Notes: A single infection was found in 487 snails. The cercaria appears to be similar to that of *Neophasis lageniformis* as described by Koie (1973). Some opecoelid-like genera with body spination including *Neophasis* have been placed in this family by Gibson and Bray (1982).

Family MICROPHALLIDAE
 Tribe MARITREMATIDI

27. *Maritrema gratiosum* Nicoll, 1907
 Stage: Metacercaria
 Location: Hemocoel
 Host: *Balanus glandula* Darwin
 Locality: Vancouver, BC
 Record: Ching (1978)

28. *Maritrema laricola* Ching, 1962
 Stage: Xiphidiocercaria
 Location: Sporocyst in digestive gland
 Hosts: *Littorina scutulata* Gould, Checkered Periwinkle; *L. sitkana* Philippi, Sitka Periwinkle
 Stage: Metacercaria
 Location: Digestive gland
 Hosts: *Hemigrapsus nudus* (Dana), *H. oregonensis* (Dana)
 Localities: Vancouver, BC; Bodega Bay, CA
 Records: Ching (1962b), Ching, 1986*

29. *Maritrema megametrios* Deblock and Rausch, 1968
 Stage: Metacercaria
 Location: Hemocoel
 Hosts: *Telorchestia traskiana* (Simpson), *Gnorimosphaera oregonense* Dana
 Locality: Vancouver, BC
 Record: Ching (1974)
 USNM Helm. Coll. No. 81077

30. *Maritrema pacifica* Ching, 1974
 Stage: Metacercaria
 Location: Hemocoel
 Host: *Megalorchestia corniculata* (Stout)
 Locality: Santa Barbara, CA
 Record: Ching (1974)
 USNM Helm. Coll. No. 81078

31. *Probolocoryphe uca* (Sarkisian, 1957) Yamaguti, 1971
 Stage: Xiphidiocercaria
 Location: Sporocyst in digestive gland
 Host: *Cerithidea californica*
 Stage: Metacercaria
 Location: Muscles
 Host: *Uca crenulata* (Lockington)
 Localities: Upper Newport Bay, Bolinas Lagoon, CA

Records: Maxon and Pequegnat (1949), Sarkisian (1957), Martin (1972) as the larger of 2 stylet cercariae, Sousa (1983) as a microphallid cercaria, Ching and Sousa for cercarial stage, 1986* Cercaria, USNM Helm. Coll. No. 81079

32. *Pseudospelotrema japonicum* Yamaguti, 1939
Stage: Metacercaria
Location: Thoracic ganglion
Host: *Cancer magister* Dana
Localities: Willapa Bay, WA; Vancouver, BC
Records: Sparks and Hibbert (1981), identified by Ching, 1988*

Tribe MICROPHALLIDI

33. *Ascorhytis charadriformis* (Young, 1949) Ching, 1965
Stage: Xiphidiocercaria
Location: Sporocyst in digestive gland
Hosts: *Littorina scutulata*, *L. sitkana*
Stage: Metacercaria
Hosts: *Hemigrapsus oregonensis*, *H. nudus*
Location: Thoracic ganglion
Localities: Bodega Bay, CA to Vancouver, BC
Records: Ching (1962c, 1965b)

34. *Microphallus nicolli* (Cable and Hunninen, 1940) Baer, 1943
Stage: Xiphidiocercaria
Location: Sporocyst in digestive gland
Host: *Olivella plicata* (Sowerby), Purple Dwarf Olive
Stage: Metacercaria
Location: Hemocoel
Host: *Emerita analoga* (Stimpson)
Locality: Santa Barbara, CA
Records: Young (1938). Yoshino (1975) reported this species in *Cerithidea californica* but the cercaria in this host is *Probolocoryphe uca* according to Sarkisian (1957).

35. *Microphallus pirum* (Afanassew, 1941) Belopolskaya, 1952
Stage: Xiphidiocercaria
Location: Sporocyst in digestive gland
Host: *Nucella emarginata*
Stage: Metacercaria
Location: Abdomen
Hosts: *Pagurus hirsutusculus* (Dana), *Telmessus cheiragonos* (Tilsius)
Locality: Alaska
Records: Schiller (1954, 1959)

36. *Microphallus pygmaeus* (Levinsen, 1881) Baer, 1943
Stage: Metacercaria
Location: Sporocyst in digestive gland
Hosts: *Littorina scutulata*, *L. sitkana*
Localities: Friday Harbor, WA; Vancouver, BC
Record: Ching (1961)
USNM Helm. Coll. No. 81080

37. *Microphallus similis* (Jagerskiold, 1900) Baer, 1943
Stage: Metacercaria
Location: Digestive gland
Host: *Cancer magister*
Locality: Vancouver, BC
Record: Ching, 1988*; many specimens from avian hosts have been recovered

38. *Microphallus* sp. *mihi* 5 (Fig. 3)
Stage: Metacercaria
Location: Sporocyst in digestive gland
Host: *Alvania compacta* Carpenter, Compact Alvania
Locality: Saturnina I., BC
Record: Ching, 1977*
USNM Helm. Coll. No. 81081
Notes: The prevalence was 5.4% or 26 of 487 snails. Measurements on 10 metacercariae: Body length by width, 152–180 by 76–112 (168 by 90). Oral sucker diameter 26–30 (30), ventral sucker diameter 16–20 (18). Pharynx as large as ventral sucker, male papilla diameter, 8–12 (10).

39. Microphallid Cercaria *mihi* 6
Stage: Xiphidiocercaria
Location: Sporocyst in digestive gland
Host: *Lacuna marmorata* Dall
Locality: Friday Harbor, WA
Record: Ching, 1959*. Three of 6 snails were infected.

40. Microphallid Cercaria *mihi* 7
Stage: Xiphidiocercaria
Location: Sporocyst in digestive gland
Host: *Trichotropis cancellata* (Hinds), Cancellate Hairy-shell
Locality: Friday Harbor, WA
Record: Ching, 1959*. Two of 108 snails were infected.

41. Microphallid Cercaria *mihi* 8 (Fig. 4)
Stage: Xiphidiocercaria
Location: Sporocyst in digestive gland
Host: *Littorina scutulata*
Locality: Vancouver, BC
Record: Ching, 1974*
Notes: I have found only 2 infections in many years of sampling littorine snails. Measurements on 10: Body length by width, 120–171 by 26–42 (132 by 37). Tail short, used for creeping, 26–39 by 5–9 (37 by 7).

Family OPECOELIDAE

42. *Cercaria searlesiae* Miller, 1925
Stage: Cotylocercous cercaria
Location: Redia in digestive gland
Host: *Searlesia dira* (Reeve)
Locality: Friday Harbor, WA
Record: Miller (1925)

43. Metacercaria A Thompson and Margolis, 1987
Stage: Metacercaria
Location: Somatic musculature
Host: *Pandalus jordani* Rathburn, Smooth Pink Shrimp
Locality: Vancouver I., BC
Record: Thompson and Margolis (1987)

44. *Neolebouria tinkerbelli* Thompson and Margolis, 1987
Stage: Metacercaria
Location: Heart
Host: *Pandalus jordani*
Locality: Vancouver I., BC
Record: Thompson and Margolis (1987)

45. *Podocotyle enophrysi* Park, 1937
Stage: Cotylocercous cercaria
Location: Redia in digestive gland

Host: *Lacuna marmorata* Dall
Locality: Saturnina I., BC
Record: Ching (1979)

46. Opecoelid Cercaria *mihi* 9
Stage: Stumpy-tailed cercaria
Location: Sporocyst in digestive gland
Hosts: *Margarites* sp., *M. helicinus*
Localities: Friday Harbor, WA; Saturnina I., BC
Records: Ching, 1957*, 1977*
Note: The cercaria has a short tail with 5–6 glands forming a striated appearance at the tip which is unlike the tails of the corylocercous cercariae listed above.

47. Opecoelid Metacercaria
Stage: Metacercaria
Location: Hemocoel
Host: *Traskorchestia traskiana*
Locality: Vancouver, BC
Record: Ching, 1977*

48. Opecoelid Metacercaria
Stage: Metacercaria
Location: Abdominal muscles
Host: *Crangon alaskensis* Lockington
Locality: Sinclair Inlet, WA
Record: Morado and Sparks (1983). I have placed this metacercaria in the family Opecoelidae.

Family MONORCHIIDAE

49. *Telolecithus pugetensis* Lloyd and Guberlet, 1932
Stage: Brevifurcate cercaria
Location: Sporocyst in gonads
Host: *Nutricola tantilla* (Gould)
Stage: Metacercaria
Location: Extrapolial cavity
Hosts: *N. tantilla*; *Macoma nasuta*, Conrad Bent-nose Macoma; *Tellina nuculoides* (Reeve), Salmon Tellin
Localities: Yaquina Bay, OR; Friday Harbor, WA
Record: DeMartini and Pratt (1964)

Family RENICOLIDAE

50. *Renicola buchanani* Martin and Gregory, 1951
Stage: Magnacercous cercaria
Location: Sporocyst in mantle
Host: *Cerithidea californica*
Localities: Upper Newport Bay, Bolinas Lagoon, CA
Records: Martin and Gregory (1951), Martin (1955), Yoshino (1975) as *Renicola* sp., Ching and Sousa, 1986*
USNM Helm. Coll. No. 81082

51. *Renicola cerithidicola* Martin, 1971
Stage: Gymnocephalous cercaria
Location: Sporocyst in digestive gland
Host: *Cerithidea californica*
Record: Martin (1971)

52. *Renicola thaidus* Stunkard, 1964
Stage: Xiphidiocercaria
Location: Sporocyst in digestive gland
Host: *Nucella lamellosa*
Stage: Metacercaria
Location: Digestive gland
Host: *Mytilus edulis*
Locality: Vancouver, BC
Records: Ching, 1957*, 1961*, 1969*, Stunkard (1964)

53. Renicolid Cercaria *mihi* 10 (Fig. 5)
Stage: Xiphidiocercaria
Location: Sporocyst in digestive gland
Host: *Cerithidea californica*
Locality: Bolinas Lagoon, CA
Record: Ching and Sousa, 1986*
USNM Helm. Coll. No. 81083
Notes: Sporocyst with yellow pigment, sparsely filled with 2–14 (8) cercariae, 676 by 298 in length and width. Cercarial body finely spined, 179–230 by 58–78 (199 by 69). Suckers equal in size, about 30 in diameter. Short stylet present. Excretory bladder U-shaped with long stem, arms lateral to ventral sucker. Flame cells 2[(3 + 3 + 3) + (3 + 3 + 3)]. Tail length by width, 110–150 by 13–16 (133 by 15).

Order LEPOCREADIIFORMES

Family LEPOCREADIIDAE

54. Lepocreadiid Cercaria *mihi* 11 (Figs. 6, 7)
Stage: Trichocercous cercaria
Location: Redia in digestive gland
Host: *Nitidella carinata* (Hinds), Carinate Dove-shell
Locality: Saturnina I., BC
Record: Ching, 1979*
USNM Helm. Coll. No. 81084
Notes: The prevalence was 5% or 4 of 73 snails. The cercaria has a trumpet-shaped oral sucker, prominent eye spots, and excretory bladder reaching to the ventral sucker. The tail has 36 pairs of setae.

Order ECHINOSTOMATIFORMES

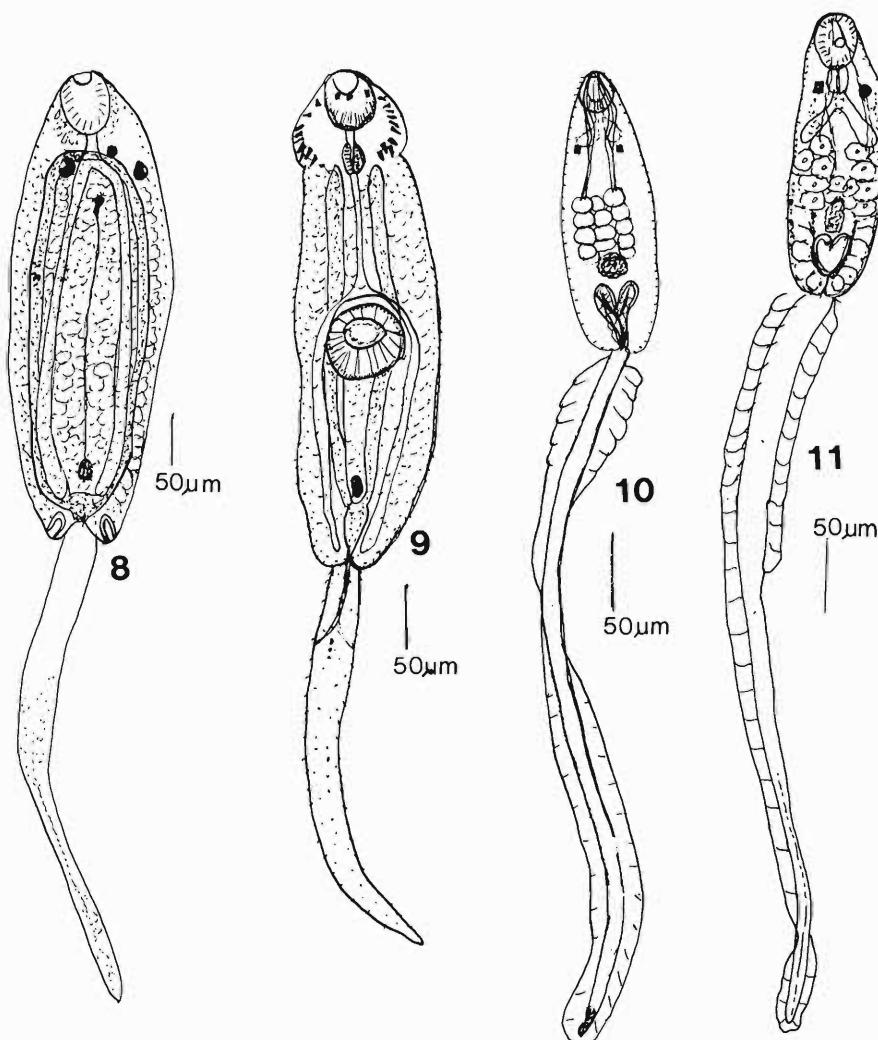
Family NOTOCOTYLIDAE

55. *Catatropis johnstoni* Martin, 1956
Stage: Oculate, monostome cercaria
Location: Redia in digestive gland
Host: *Cerithidea californica*
Locality: Upper Newport Bay, Bolinas Lagoon, CA
Records: Martin (1955, 1956), Yoshino (1975), Sousa (1983)

56. Notocotyliid Cercaria *mihi* 12 (Fig. 8)
Stage: Oculate, monostome cercaria
Location: Redia in digestive gland
Host: *Littorina scutulata*
Locality: Vancouver, BC
Records: Ching (1962a), 1977*
USNM Helm. Coll. No. 81085
Notes: The prevalence was 0.49% or 21 of 4,322 snails sampled in 1977–1978 from 3 locations in Vancouver. Measurements on 10 cercariae: Body length by width, 330–595 by 145–244 (419 by 216). Tail length by width, 376–508 by 33–66 (422 by 43). Three eye spots present.

Family ECHINOSTOMATIDAE

57. *Acanthoparyphium spinulosum* Johnston, 1917
Stage: Cercaria with collar spines
Location: Redia in gonads
Host: *Cerithidea californica*
Stage: Metacercaria



Figures 8–11. Marine digenous from gastropod hosts. 8. Notocotylid cercaria from *Littorina scutulata*. 9. Echinostomatid cercaria of *Himasthla* sp. from *L. scutulata*. 10. Heterophyid cercaria from *Batillaria zonalis*. 11. Heterophyid cercaria from *Bittium escherichtii*.

Location: Radular pockets
 Host: *Cerithidea californica*
 Localities: Upper Newport Bay, Bolinas Lagoon, CA
 Records: Martin and Adams (1960, 1961), Yoshi-
 no (1975), Sousa (1983), Ching and Sousa, 1986*
 USNM Helm. Coll. No. 81086

58. *Acanthopharyphium* sp.
 Stage: Cercaria with collar spines
 Location: Redia in gonads
 Host: *Cerithidea californica*
 Locality: Upper Newport Bay, CA
 Record: Martin (1972)

59. “*Echinoparyphium*” sp.
 Stage: Cercaria with collar spines
 Location: Redia in gonad, digestive gland

Host: *Cerithidea californica*
 Localities: Upper Newport Bay, Bolinas Lagoon, CA
 Records: Martin (1972), Sousa (1983), Ching and
 Sousa, 1986*. Martin (1972) placed this echino-
 nostome in this genus, but the 31 spines around
 the head collar are arranged in a single ring dor-
 sally and laterally, with 2 clustered at each side
 ventrally.
 USNM Helm. Coll. No. 81087

60. *Himasthla rhigedana* Dietz, 1909
 Stage: Oculate cercaria with collar spines
 Location: Redia in digestive gland
 Host: *Cerithidea californica*
 Localities: Upper Newport Bay, Bolinas Lagoon,
 CA

Records: Adams and Martin (1960, 1963), Yoshino (1975), Sousa (1983), Ching and Sousa, 1986*
USNM Helm. Coll. No. 81088

61. *Himashla* sp. Cercaria *mihi* 13 (Fig. 9)
Stage: Cercaria with collar spines
Location: Redia in digestive gland
Host: *Littorina scutulata*
Localities: Friday Harbor, WA; Vancouver, BC
Records: Ching (1962a as echinostome I), 1975–1978*, 1988*
USNM Helm. Coll. No. 81089
Notes: The prevalence was 2.5% or 21 of 835 snails at Vancouver and Friday Harbor from 1975 to 1978. At 1 lagoon site at Friday Harbor in 1988, 11% or 23 of 207 snails were infected. Cercarial body spined, with head collar of 29 spines in single continuous row, with 2 ventrally in each corner. Body length by width, 352–454 by 123–217 (400 by 158). Oral sucker 51–59 by 51–56 (57 by 52), ventral sucker, 64–70 by 66–102 (75 by 82). Tail length by width, 237–409 by 33–57 (319 by 41).

62. Echinostomatid Metacercaria
Stage: Metacercaria with collar spines
Location: Gut, mantle, base of gills
Host: *Protothaca staminea* (Conrad), Common Pacific Littleneck
Locality: Sooke, BC
Record: Bower, 1986* pers. comm., Pacific Biological Station, Nanaimo, BC

Family PHILOPHTHALMIDAE

63. *Cloacitrema michiganensis* McIntosh, 1938
Stage: Megalurous cercaria
Host: *Cerithidea californica*
Locality: Upper Newport Bay, CA
Records: Robinson (1952), Martin (1955, 1972), LeFlore et al. (1985)

64. *Parorchis acanthus* (Nicoll, 1906) Nicoll, 1907
Stage: Megalurous cercaria
Location: Redia in digestive gland
Host 1: *Cerithidea californica*
Localities: Upper Newport Bay, Bolinas Lagoon, CA
Records: Martin (1955, 1972), Yoshino (1975), Sousa (1983), Ching and Sousa, 1986*
USNM Helm. Coll. No. 81090
Host 2: *Nucella lamellosa*, *N. emarginata*
Locality: Thetis I., BC
Record: Ching (1978)
USNM Helm. Coll. No. 81091

Family PSIOSTOMIDAE

65. *Psilostomum magniovum* Ching, 1980
Stage: Cercaria with caudal fin fold
Location: Redia in digestive gland
Host: *Littorina scutulata*
Stage: Metacercaria
Location: Extrapallial cavity
Host: *Mytilus edulis* L., Blue Mussel
Locality: Vancouver, BC
Record: Ching (1980)

Order OPISTHORCHIIFORMES
Family HETEROPHYIDAE

66. *Cercaria purpuracauda* Miller, 1925
Stage: Magnacercous cercaria
Location: Redia in digestive gland
Host: *Bittium escherichtii* (Middendorf), Giant Pacific Coast Bittium
Locality: Friday Harbor, WA
Record: Miller (1925)

67. *Cryptocotyle lingua* (Creplin, 1825) Fischoeder, 1903
Stage: Pleurolophocercous cercaria
Location: Redia in gonads
Host: *Littorina scutulata*
Locality: Vancouver, BC
Record: Ching (1978)
USNM Helm. Coll. No. 81092

68. *Euhaplorchis californiensis* Martin, 1950
Stage: Pleurolophocercous cercaria
Location: Gonad (redial stage in digestive gland)
Host: *Cerithidea californica*
Localities: Upper Newport Bay, Bolinas Lagoon, CA
Records: Martin (1950a, 1955), Yoshino (1975), Sousa (1983), Ching and Sousa, 1986*
USNM Helm. Coll. No. 81093

69. *Parastictodora hancocki* Martin, 1950
Stage: Pleurolophocercous cercaria
Location: Redia in gonads
Host: *Cerithidea californica*
Locality: Upper Newport Bay, CA
Records: Martin (1950b, 1955)

70. *Phocitremoides ovale* Martin, 1950
Stage: Pleurolophocercous cercaria
Location: Redia in gonads
Host: *Cerithidea californica*
Localities: Upper Newport Bay, Bolinas Lagoon, CA
Records: Martin (1950c), Ching and Sousa, 1986*
USNM Helm. Coll. No. 81094

71. *Pygidiospoides spinialis* Martin, 1951
Stage: Pleurolophocercous cercaria
Location: Redia in gonads
Host: *Cerithidea californica*
Locality: Upper Newport Bay, CA
Record: Martin (1951)

72. Heterophyid Cercaria *mihi* 14 (Fig. 10)
Stage: Pleurolophocercous cercaria
Location: Redia in gonads
Host: *Batillaria zonalis* (Bruguiere) Cumings, False Cerith
Locality: Vancouver, BC
Records: Ching, 1978*, 1989*
USNM Helm. Coll. No. 81095
Notes: The prevalence was 10% or 8 of 77 in 1978 and 22% or 12 of 54 in 1989 in 2 sites in BC. Measurements of 10 cercariae: Body finely-spined, length by width, 139–211 by 66–99 (184 by 80). Tail with finfold ending in small fan around the tip, length by width, 297–475 by 17–36 (366 by 27). Oral sucker with subterminal opening with glandular openings, crenulated walls, 25–46 by 31–37 (31 by 36). Eyespots al-

most square. Penetration glands 14 in total. A pleurolophocercous cercaria reported from this host in California by Whitlatch (1974) may be the same species.

73. *Heterophyid Cercaria mihi* 15 (Fig. 11)
 Stage: Pleurolophocercous cercaria
 Location: Redia in gonads
 Host: *Bittium escherichtii*
 Locality: Vancouver, BC
 Record: Ching, 1974*

USNM Helm. Coll. No. 81096
 Notes: The prevalence was 9.6% or 5 of 52 snails.
 Measurements on 9 cercariae: Body length by width, 164–188 by 60–66; tail with short anterior folds, fin folds continuing around bent tip, length by width, 248–409 by 25–30. Oral sucker with 8 spines on the dorsal edge followed by 5 tubular spines in the opening of the mouth. Penetration glands filling body, about 16 in total.

List 2. Molluscan Hosts of Larval Digeneans of the North American Pacific Coast
 (Name of mollusc: number of larval digenean in List 1)

GASTROPODA:

Alvania compacta: 10, 26, 38
Batillaria zonalis: 72
Bittium escherichtii: 66, 73
Ceratostoma foliatum: 25
Cerithidea californica: 1, 2, 4, 31, 50, 51, 53, 55, 57, 58, 59, 60, 63, 64, 68, 69, 70, 71
"Collisella" scabra: 23
Ilyanassa obsoleta: 3
Lacuna marmorata: 39, 45
Littorina planaxis: 5
Littorina scutulata: 28, 33, 36, 41, 56, 61, 65, 67
Littorina sitkana: 28, 33, 36
Lottia digitalis: 23
Margarites costalis: 16
Margarites helcinus: 16, 46
Margarites pupillus: 16
Margarites sp.: 46
Nitidella carinata: 54
Nucella canaliculata: 11
Nucella emarginata: 11, 35, 64
Nucella lamellosa: 6, 52, 64

Olivella plicata: 34

Searlesia dira: 42
Trichotropis cancellata: 40

SCAPHOPODA:

Dentalium dalli: 7

BIVALVIA:

Crassostrea gigas: 24
Cryptomya californica: 19
Gemma gemma: 22
Lyonsia sp.: 13
Macoma inconnspicua: 14, 18, 20, 21
Macoma nasuta: 49
Mya arenaria: 19
Mytilus californianus: 12
Mytilus edulis: 17, 52, 65
Nutticola tantilla: 22, 49
Protothaca staminea: 62
Tapes philippinarum: 15
Tellina nuculoides: 49

List 3. Larval Tapeworms, Acanthocephalans, and Roundworms from Marine Invertebrates of the North American Pacific Coast

Class CESTODA

Order TETRAPHYLLIDEA

Family PHYLLOBOTHRIIDAE

1. *Anthobothrium* sp.
 Stage: Larva
 Location: Foot
 Hosts: *Tresus nuttalli* (Conrad), Pacific Gaper; *Macoma nasuta*, Bent-nose Macoma; *Protothaca staminea* (Conrad), Common Pacific Littleneck
 Locality: Elkhorn Slough, CA
 Record: MacGinitie and MacGinitie (1968)

2. *Echeneibothrium* sp.
 Stage: Plerocercoid larva
 Location: Mantle, foot
 Host: *Protothaca staminea*
 Locality: Humboldt Bay, CA
 Record: Sparks and Chew (1966)

3. *Echeneibothrium* sp.
 Stage: Larva
 Location: Foot
 Host: *Protothaca laciniata*
 Locality: Morro Bay, CA
 Record: Warner and Katkansky (1969a)

4. *Echeneibothrium* sp.
 Stage: Smaller larva
 Location: Peripheral and mantle area
 Host: *Protothaca staminea*
 Locality: Humboldt Bay, CA
 Record: Warner and Katkansky (1969b)

5. *Echeneibothrium* sp.
 Stage: Larger larva
 Location: Viscera
 Host: *Protothaca staminea*
 Locality: Humboldt Bay, CA
 Record: Warner and Katkansky (1969b)

Order TETRARHYNCHIDEA

Family TETRARHYNCHIDAE

6. *Tetrarhynchus* sp. 1 and 2

Stage: Larvae

Location: Muscle

Host: *Dosidicus gigas*

Locality: Newport Bay, CA

Record: MacGinitie and MacGinitie (1968)

Order CYCLOPHYLLIDEA

Family HYMENOLEPIDAE

7. *Hymenolepid* Cysticercoid *mihi* 16

Stage: Cysticercoid

Location: Hemocoel

Host: *Traskorchestia traskiana*

Locality: Newport Bay, OR

Record: Ching, 1974*

Phylum ACANTHOCEPHALA

Order PALAEACANTHOCEPHALA

Family POLYMORPHIDAE

1. *Polymorphus kenti* Van Cleave, 1947

Stage: Cystacanth

Location: Hemocoel

Host: *Emerita analoga* (Stimpson)

Locality: Oregon

Record: Reish (1950)

2. *Profilicollis botulus* (Van Cleave, 1916) Meyer, 1913

Stage: Cystacanth

Location: Rectal ceca

Host: *Hemigrapsus oregonensis*

Localities: Bodega Bay, CA to Vancouver, BC

Record: Ching (1989)

3. Unidentified Cystacanth

Stage: Cystacanth

Location: Midgut

Host: *Paralithodes camtschaticus* (Tilesius)

Locality: Alaska

Record: Sparks (1987)

Phylum NEMATODA

Order ASCARIDIDA

Family ANISAKIDAE

1. *Contracaecum* sp.

Stages: Juvenile and adult

Location: Hemocoel

Host: *Pandalis borealis*

Locality: Open ocean, BC

Record: Margolis and Butler (1954)

Order SPIRURIDA

Family GNATHOSTOMATIDAE

2. *Echinocephalus pseudouncinatus* Millemann, 1963

Stage: Juvenile

Location: Foot

Host: *Haliotis corrugata* Wood

Locality: San Clemente I., CA

Record: Millemann (1963)

Host: *Centrostephanus coronatus*

Location: Gonads

Locality: Southern CA

Record: Pearse and Timm (1971)

Location: Adductor muscle

Host: *Argopecten aequisulcatus* (Carpenter)

Locality: Baja California, Mexico

Record: McLean (1983)

Family CYSTIDICOLIDAE

3. *Ascarophis* sp. 1 and 2

Stage: Juveniles

Location: Hemocoel

Hosts: *Pagurus samuelis* (Stimpson), *P. granosimanus* (Stimpson)

Locality: Bodega Bay, CA

Record: Poinar and Thomas (1976)

4. *Ascarophis* sp.

Stage: Juvenile

Location: Hemocoel

Hosts: *Pachycheles pubescens* Holmes, *P. rufus*, *Pugettia producta* (Randall), *Hemigrapsus oregonensis*

Locality: Bodega Bay, CA

Records: Poinar and Thomas (1976), Poinar and Kuris (1976)

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